EXTREME FIRE BEHAVIOR

Virginia's Certified Prescribed Burning Managers Program

Crown Fires

1. What are they ?

2. What are the three stages ?

Crown Fire Definition :

A fire involving the crowns of trees or shrubs.

Crown Fire Potential

Stages of Crown Fires

Passive =

Single tree or clumps torching

Active =

Flames in crown supported by surface fire

Independent =

Flames advancing through crowns without surface fire

Crown Flammability

Crown Characteristics

1. Dead Fuel moisture
2. Foliar (live) Fuel moisture

Important : The ratio of dead to live fuel moisture

Crown Characteristics cont'd

3. Foliage Flammability

Volatile chemicals in fuel

4. Crown Closure

75 % or more

very helpful in heat transfer

Surface to Crown Heat Transfer

1. Surface fire intensity
2. Vertical arrangement (ladder fuels)
3. Steepness of slope


CROWN TO CROWN
HEAT TRANSFER

Crown to Crown Heat Transfer

1. Crown Spacing
   - 20 feet or less
   - 100 stems / acre or more
2. Crown level Winds
   - 20 foot winds of 20 mi/h or greater
3. Steepness of Slope
   - Acts as wind


SPOTTING PROBLEM
FIREBRAND SOURCE
TRANSPORTATION
RECEIVING FUELS AND ENVIRONMENT

Firebrand Source

Probability of Production

Number of Firebrands

Type of Firebrand

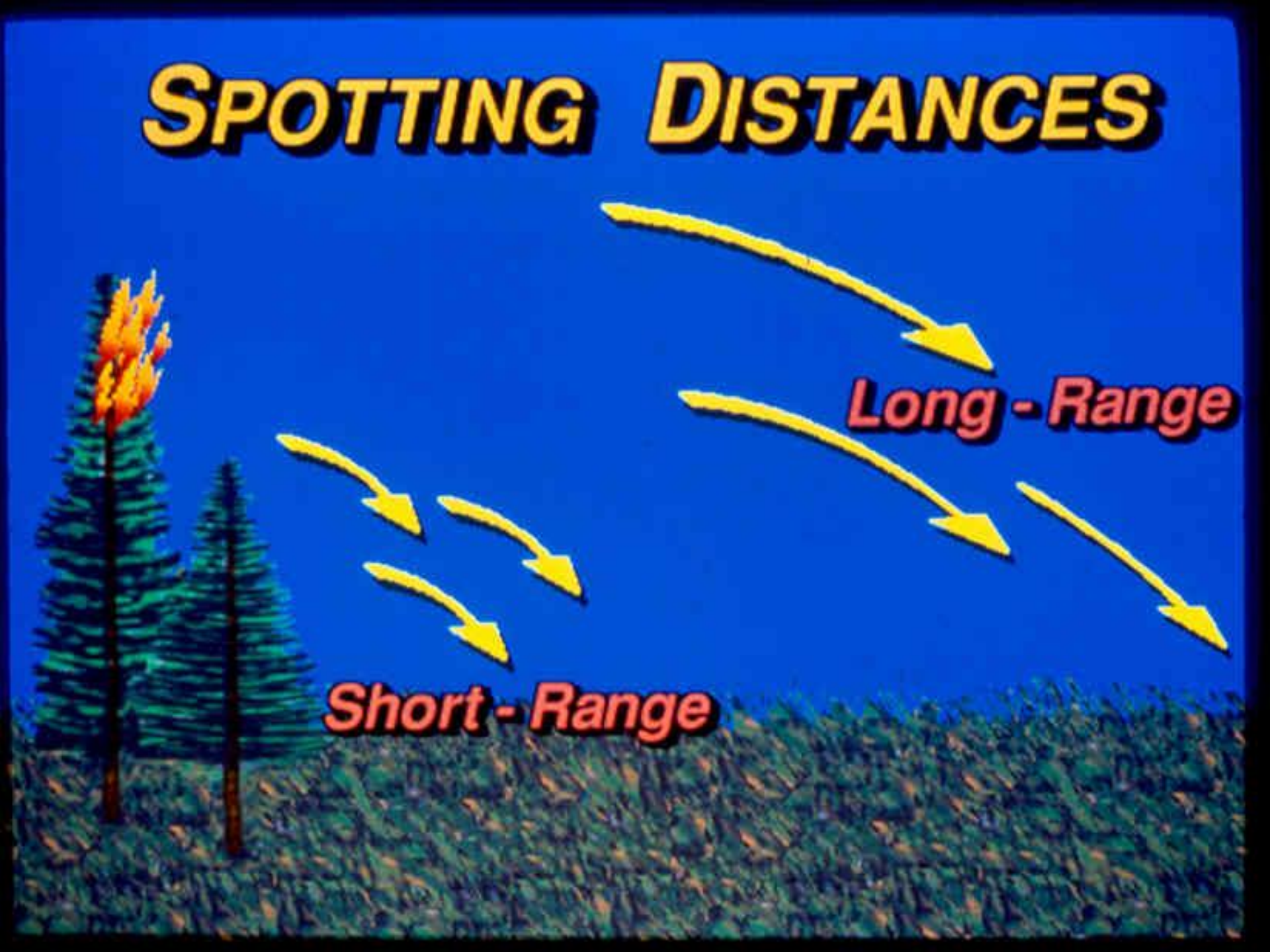
TRANSPORTATION

Receiving Fuels and Environment

Receptive Fuels

Probability of Ignition

Environmental Conditions


SPOTTING DISTANCES
Long - Range
Short - Range

Probability of Ignition :

The chance that a firebrand will cause an ignition when it lands on receptive fuels.

Probability of Ignition

70% or 7 out of 10 firebrands will start a fire.

Probability of Ignition is calculated for the point of ignition from :

- 1- Hour dead fuel moisture.
- Dry bulb temperature.
- Fuel shading.

PROBABILITY OF IGNITION TABLE

Shading (Percent)	Dry-Bulb Temp. (°F)	FINE DEAD FUEL MOISTURE (PERCENT)															
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Unshaded <50%	110+	100	100	80	70	60	60	50	40	40	30	30	20	20	20	20	10
	100-109	100	90	80	70	60	60	50	40	40	30	30	20	20	20	10	10
	90-99	100	90	80	70	60	50	40	40	30	30	30	20	20	20	10	10
	80-89	100	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10
	70-79	100	80	70	60	60	50	40	40	30	30	20	20	20	10	10	10
	60-69	90	80	70	60	50	50	40	30	30	20	20	20	20	10	10	10
	50-59	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	40-49	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	30-39	80	70	60	50	50	40	30	30	20	20	20	10	10	10	10	10
Shaded >50%	110+	100	90	80	70	60	50	50	40	40	30	30	20	20	20	10	10
	100-109	100	90	80	70	60	50	50	40	30	30	30	20	20	20	10	10
	90-99	100	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10
	80-89	100	80	70	60	60	50	40	40	30	30	20	20	20	10	10	10
	70-79	90	80	70	60	50	50	40	30	30	30	20	20	20	10	10	10
	60-69	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	50-59	90	80	70	60	50	40	40	30	30	20	20	20	10	10	10	10
	40-49	90	80	60	50	50	40	30	30	30	20	20	20	10	10	10	10
	30-39	80	80	60	50	50	40	30	30	20	20	20	10	10	10	10	10

Probability of Ignition Exercises

Example #1

Clear day
No canopy cover
Dry bulb temperature = 86 °F
1-H fuel moisture = 5%

Probability of Igniton = _____

Probability of Ignition Exercises

Example #1

Clear day
No canopy cover
Dry bulb temperature = 86 °F
1- H fuel moisture = 5%

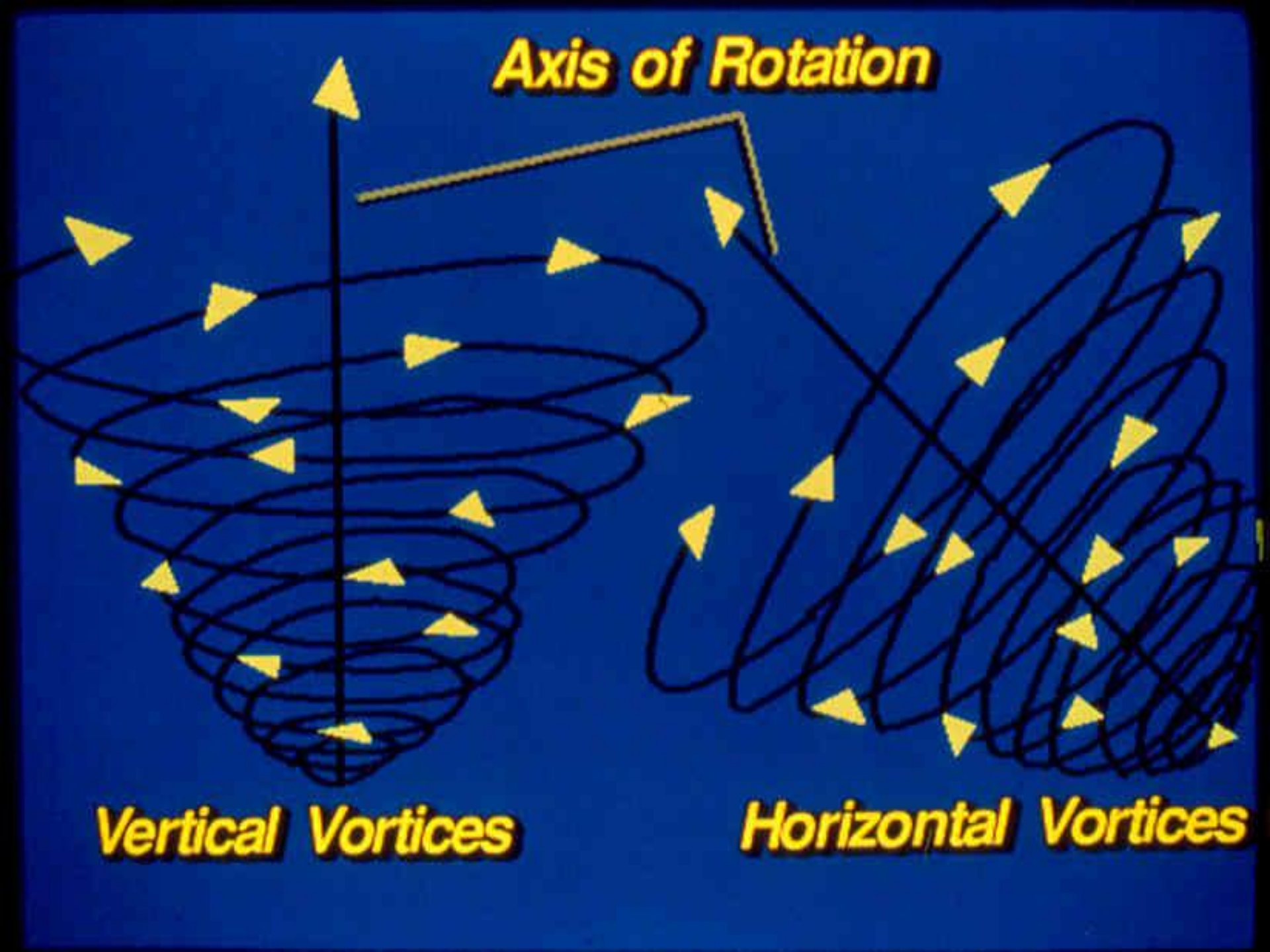
Probability of Igniton = 70%

Probability of Ignition

Relates only to the chance of initial ignition.

Vortices in Wildland Fire

- Vertical vortices
- Horizontal vortices


Axis of Rotation
Vertical Vortices
Horizontal Vortices

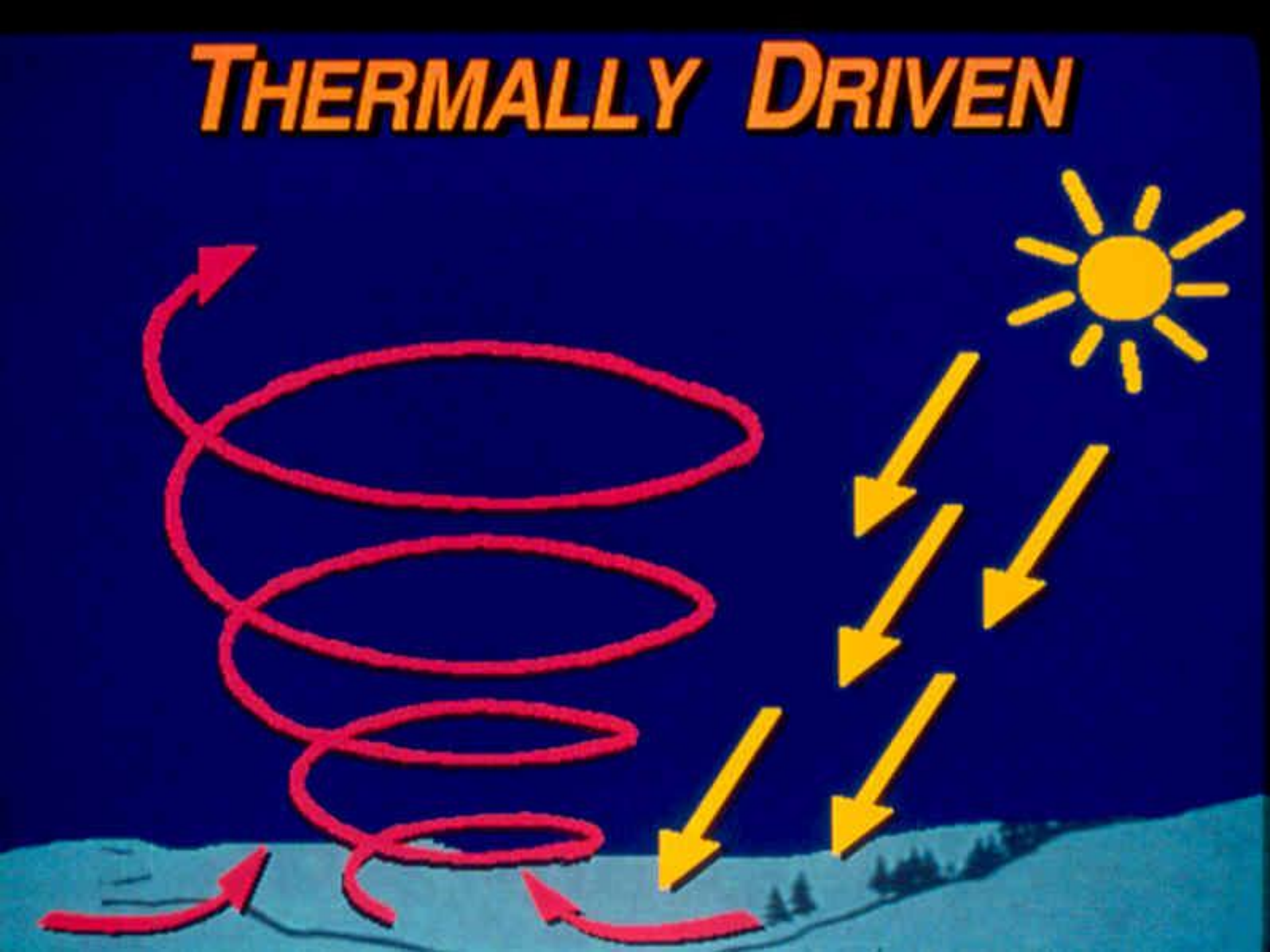
Vortice Development

- Heat source
- Initiating swirl

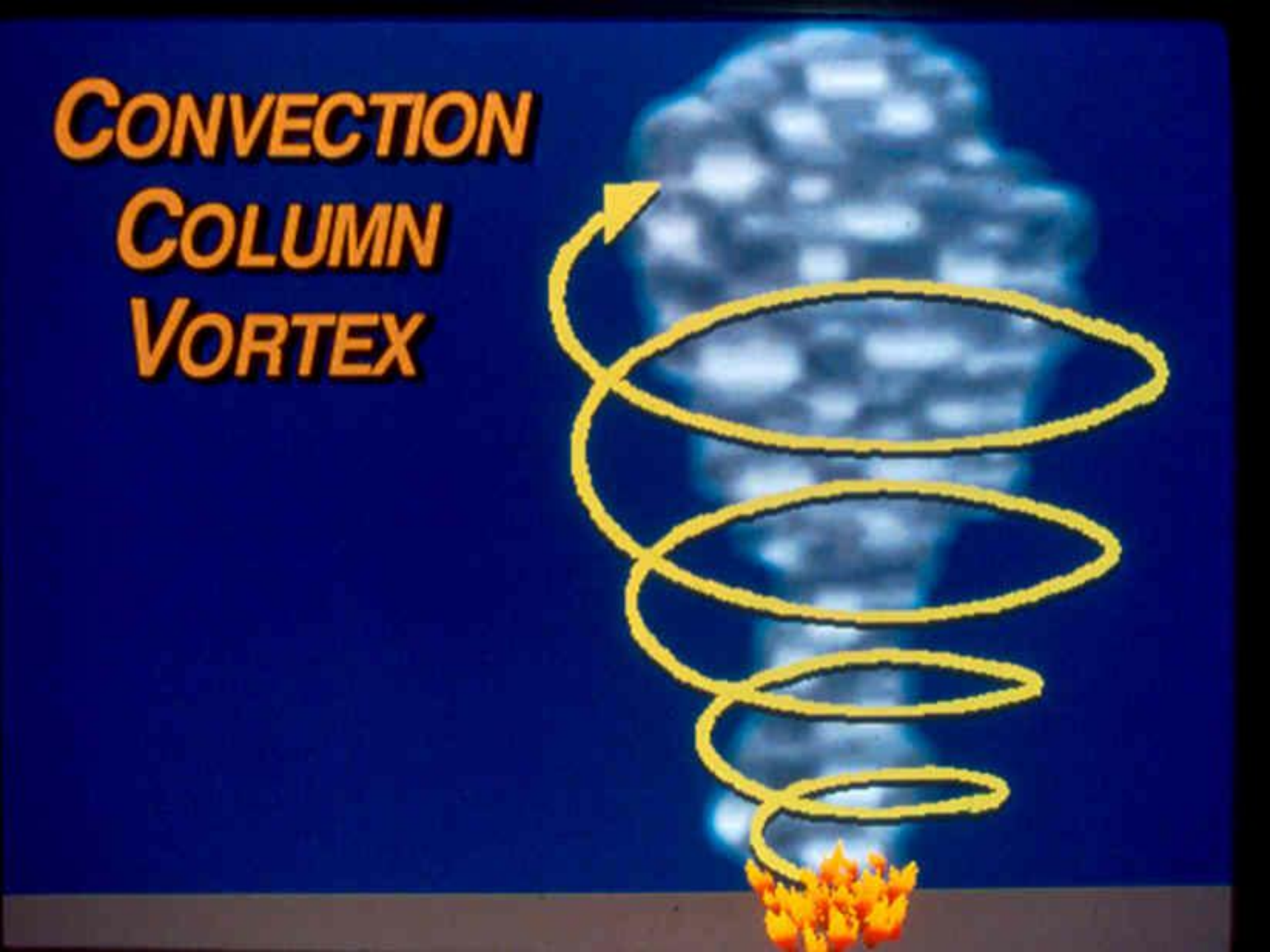
Types of Firewhirls

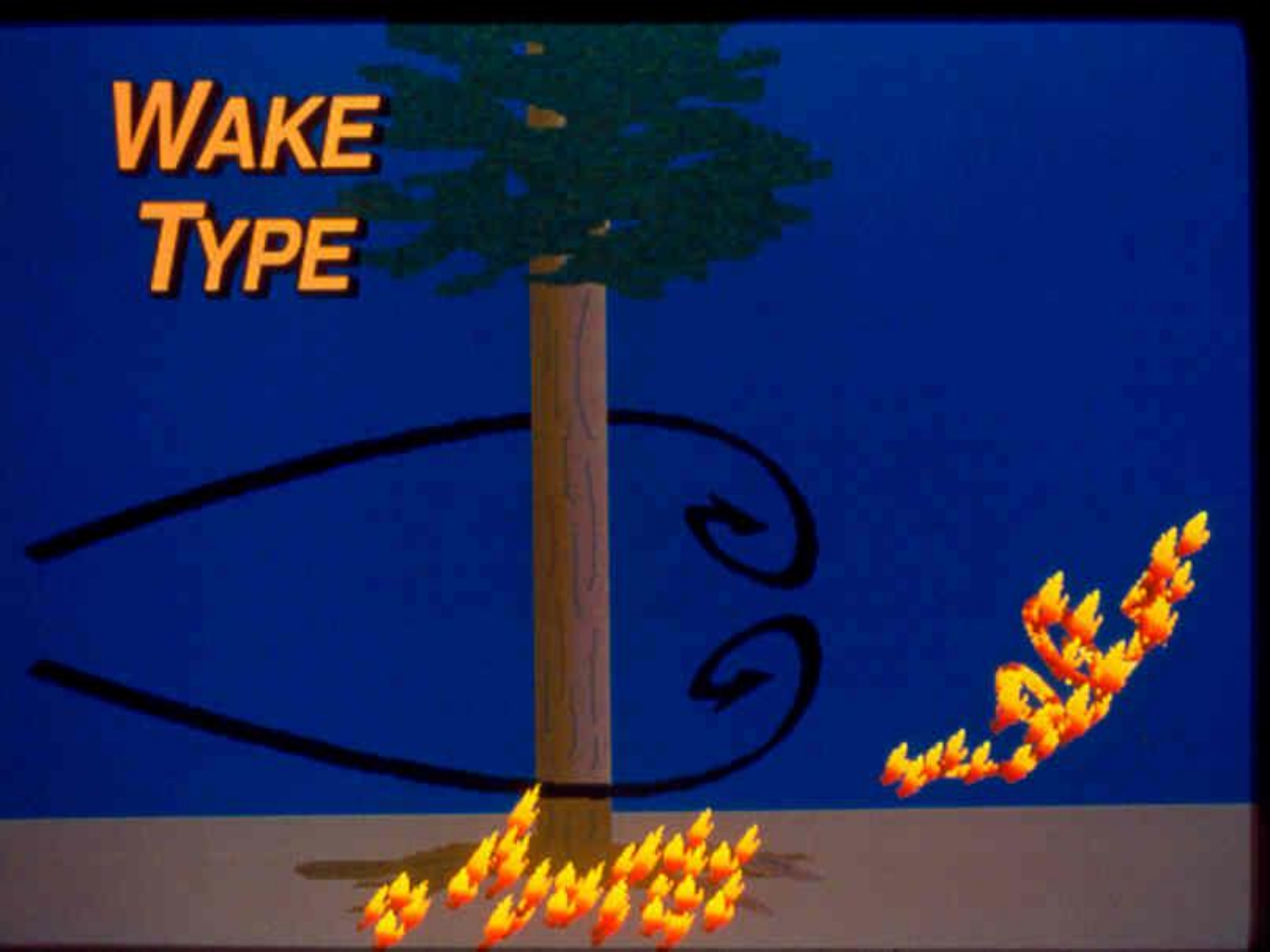
- Thermally driven
- Convection column vortex
- Wake type

THERMALLY DRIVEN



Convection Column Vortex




WAKE
TYPE

Two types of Horizontal Vortices

1. Surface - occurs along flanks

2. Column - occurs above the fire

Common Denominators

- Extreme burning conditions
- Windspeed
- Topography

Critical Concern

Horizontal vortices can occur on the FLANKS of wind-driven and plume-dominated fires.

LEAVE YOU WITH

- Need to recognize conditions that are favorable for extreme fire behavior
- Don’t burn when these conditions exist
- Be prepared to move from a prescribed burn to a fire suppression mode if necessary
- Crown Fires
- Firewhirls

MACK LAKE FIRE

MAY 5, 1980

MACK LAKE FIRE

- Which indicators of problem fire behavior were present?
- What other warnings or indicators were present prior to entrapment?
- Summarize the significant lessons you think are to be learned from the Mack Lake Fire.

SHOW VIDEO

DISCUSSION

- Fire Behavior - Ladder Fuels, Tight Crown spacing, low RH, high Temperatures, approaching cold front, trees torching, frequent spot fires
- Warnings - The weather conditions exceeded the prescription in the Plan, suppression personnel not available, Cold front increase fire danger.

LESSONS LEARNED

- Improper tactics given observed fire behavior, need good contingency plan
- Inexperience of tractor plow operator and Engine Crew contributed to the inability to recognize the danger of the situation.
- LCES violated
- Incomplete Briefing
- Exceeding burn presciption limits, lack of attention towards the weather and changing Fire Behavior (spot fires)

ESCAPE OF PRESRIBED BURN

- Spotting from Slash piles
- Irregular groups of uncut trees adjacent to the prescribed fire area
- Locating the control line near the top of a 25 percent slope
- High Windspeed (15-plus mi/h)
- Low Relative Humidity (21 percent)
- Low fine fuel moisture (7 percent)